Guidelines for Documentation of Modeling

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Purpose:

The purpose of these guidelines are to aid the modelers in the documentation of their modeling efforts associated with reports submitted to the Wisconsin Department of Natural Resources Bureau for Remediation and Redevelopment (RR). These are general guidelines, which could be applied to analytical models or numerical models of flow and contaminant transport processes. Items included in category III,IV and V generally pertain to numerical models only. The user is encouraged to expand on these guidelines to provide a comprehensive presentation of their specific application. Visual presentation of data (maps, cross sections, graphs, charts, tables, etc.) should accompany text when appropriate.

Modelers are encouraged to contact appropriate RR Program technical staff before undertaking an extensive modeling project. The appropriateness of the modeling effort can be discussed. In general, well documented and refereed models are preferred. Since most model solutions are not unique, a range of model inputs and results should be provided. The RR Program is reluctant to rely solely on modeling to support a less conservative proposal to a particular regulatory problem. In particular, we have has less confidence in contaminant transfer models than flow models.

Author/Contact:
This document was originally prepared in 1988 by Kathleen Slane, James Birkett-Bauer, and Kenneth Wade. If you have questions, please contact Resty Pelayo 608-267-3539.

The following information should be submitted for review.

I. Description of the Model

A. Include documentation and references.
B. Include a description of the way the model handles specific items of interest (for example, describe how the model simulates drains for modelling of a gradient control design). List all important governing equations.

II. Conceptual Model . Application to the Problem

A. Address the limitations of applying the model to the specific problem and assumptions made (including assumptions made abo.ut the future). Include justification.
B. Overlay the grid (for a numerical model) on a site map and/or on the geologic cross section(s) simulated. Clearly show all boundary conditions, sources, sinks, calibration and verification points, cultural features of interest (e.g. landfill outline, etc.).
C. Describe the input parameters used and how they were chosen. Present results in array form if parameters are varied. Include the range of values known and an estimate of their reliability.
D. Describe the boundary conditions and why they are appropriate to the problem.

III. Calibration

A. Discuss whether field conditions chosen for calibration are typical. Consider whether seasonal variation or other factors may cause a change in conditions with time.
B. Indicate which parameters or boundary conditions were varied to achieve calibration and whether the changes are reasonable.
C. Discuss whether the number and distribution of calibration points are adequate. Include the calibration points on a map with the grid shown.
0. Discuss how well the heads and flow rates match existing data. Consider any deviations from expected values. Include a table of results showing a comparison between field values and simulated values.
Provide possible explanation(s) for any abrupt changes in head.
F. Describe changes in conditions between the calibration run(s), verification run(s) and the predictive run(s).

IV. Quality Control

A. Discuss the numerical stability of model solutions. Describe how the grid size and time steps (transient case) for the model were optimized. Provide Peclet and Couront numbers for contaminant transport numerical solutions.
B. List the mass balance percent discrepancy between inflow and outflow for each of the runs.
C. List the closure criteria for each of the runs.
D. Document model validation runs for this problem or ti'is type of problem, i.e., can the model simulate an analytical result for this problem?
E. Describe the verification process in the same manner as the calibration process under Category III. Examples of data sets suited to the verification process include aquifer stresses such as a pump test, a drought period, or a previous gradient control installation.
F. Document the results of other numerical or analytical models which were used to check the

result of the major modelling effort.

G. Include results of a sensitivity analysis. The sensitivity analysis should encompass the range of probable input parameters for the problem. Present results in both tabular and graphical form.

V. Presentation of Results

A. If possible, present the results in a manner which will reflect the resolution of the grid (e.g., if a water table is shown on a cross section, show the step function of the grid instead of smoothly connecting points in the center of each cell).

B. Show flow vectors and potentials.

C. Include a table of flow volumes te or from boundaries. Group according to an identifiable subset, such as a wetland(s), lake(s), river(s), pumping well(s), and/or a drain(s).

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For More Information

To order this and any other publications, or to find out more information about the Remediation and Redevelopment Program, please call our Information Line at 800-367-6076 (long distance in-state) or 608-264-6020 (local or out-of-state); or check out our web site at http://www.dnr.state.wi.us/org/aw/rr.

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